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EXAMINER

UMEZ ERONINI, LYNETTE T

ART UNIT PAPER NUMBER

1765

DATE MAILED: 06/03/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/082,010

Applicant(s)

SINGH ET AL.

Examiner

Lynette T. Umez-Eronini

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 01 March 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-48 is/are pending in the application.
- 4a) Of the above claim(s) 27 and 28 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-26 and 29-48 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 11-16 and 38-48 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 11, lines 1-2, "wherein a selectivity of a CMP process . . . is at least approximately 20 . . ."

In claims 12, lines 1-2, and wherein a selectivity of a CMP process . . . is at least approximately 100 . . . ;"

In claim 13, lines 1-2, "wherein a selectivity of a CMP process . . . is at least 0.5 . . . ;"

In claim 14, lines 1-2, "wherein a selectivity of a CMP process . . . is at least 2.0 . . . ;"

In claim 15, lines 1-2 "wherein a selectivity of a CMP process . . . is at least approximately 100 . . . ;"

In claim 16, lines 1-2 "wherein a selectivity of a CMP process . . . is at least approximately 1000 . . . ;"

In claim 38, lines 1-2, "wherein said slurry provides adsorption ratio (AR) . . . of no more than 5, . . . ;"

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In claim 39, lines 1-2, and

In claim 42, lines 1-2 "wherein AR . . . is at least 100;"

In claim 40, lines 1-2, and

In claim 43, lines 1-2, "wherein AR ... is at least 500;"

In claim 41, lines 1-3, "wherein said slurry provides an adsorption ratio (AR) ... of no more than 2,...;"

In claim 44, lines 1-3, "wherein said slurry provides a selective adsorption ratio (SAR) ... of at least one;"

In claim 45, lines 1-3, "wherein said slurry provides a selective adsorption ratio (SAR) ... of at least 50;"

In claim 46, lines 1-3, "wherein said slurry provides a selective adsorption ratio (SAR) ... of at least 100;"

In claim 47, line 3, "wherein said slurry provides a selective ... of at least 50 ...;"
and

In claim 48, line 3, "wherein said slurry provides a selective ... of at least 100 ...;"
is indefinite because for failing to show the "selectivity" and the "adsorption ratio (AR)" represents a ratio between two or more materials.

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Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-16, 18-23, and 31-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman (US 5,954,997) as applied to claim 1 above, and further in view of Yano et al. (US 6,454,819 B1).

Kaufman teaches, "The chemical mechanical polishing slurry, ("CMP slurry") . . . comprises an oxidizer, an abrasive, a complexing agent, a film forming agent, and other optional ingredients" (column 5, lines 1-5). "The abrasive is typically a metal oxide abrasive. The metal oxide abrasive may be selected from the group including alumina, titania, zirconia, germania, silica, ceria and mixtures (column 7, lines 2-5). "The oxidizer . . . may be . . . hydrogen peroxide . . ." (column 5, lines 28-37). "Useful complexing

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agents include but art not limited to acids such as citric, lactic, tartaric, succinic, acetic, oxalic and other acids, . . .” (column 6, lines 5-8). “A preferred film forming agent is benzotriazole (“BTA”)” (column 5, lines 55-56). Kaufman also teaches, “a variety of optional CMP slurry additives, such as surfactants, . . . can be used . . . “If a surfactant is added to the CMP slurry, then it may be an anionic, cationic, nonionic, or amphoteric surfactant or a combination of two or more surfactants can be employed” (column 6, lines 36-41). “Preferred surfactants include dodecyl sulfate sodium salt, sodium lauryl sulfate, . . . and mixture thereof” (column 6, lines 62-64). Since Kaufman uses a CMP slurry that contains abrasive materials (same as applicants’ composite particles) and an optional additive such a surfactant (same as applicants’ adsorption additive), then the above reads on a cmp slurry comprising: a plurality of composite particles and at least one selective adsorption additive. “The CMP slurry of this invention may be produced using conventional techniques known in the art. Typically, the oxidizing agent and other non-abrasive components, are mixed into an aqueous medium, such as deionized or distilled water, . . .” (column 8, lines 43-49). Hence the above reads on,

A slurry chemical mechanical polishing (CMP) of a structure including a refractory metal based barrier film and a dielectric film, comprising:

a bulk solution;

a plurality of composite particles and at least one selective adsorption additive, said composite particles including an inorganic core surrounded by a shell including said selective adsorption additive, wherein said selective adsorption additive is

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substantially adsorbed by said dielectric film but not substantially adsorbed by said refractory metal based barrier film, **in claim 1**;

Kaufman differs in failing to specify the concentrations of the selective adsorption additive as recited **in claims 1-5, 7**, and core particles, **in claim 35**; and the selectivity of the CMP process, **in claims 11-16**.

It is acknowledged that Kaufman teaches the limitations of the claimed invention but fails to specify concentrations of the adsorption additive and core particles; and the selectivity of CMP. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select any specific range of concentrations of the adsorption additive (surfactant) and selectivity in the Kaufman reference, including applicants' specifically claimed concentrations because the adsorption additives are considered to be equivalent for the purpose reducing the within-wafer-nonuniformity (WIWNU) of the wafers, thereby improving the surface of the wafer and reducing wafer defects (Kaufman, column 6, lines 52-55).

Kaufman teaches the CMP slurry contains a metal oxide abrasive having a primary particle diameter less than 0.4 micron (400 nm) (column 7, lines 1-9 and column 8, lines 4-8) and a variety of optional additives such as surfactants. The surfactants may be anionic, cation, nonionic, or amphoteric or a combination of two or more surfactants and the addition of a surfactant may be useful in improving the surface of the wafer and reducing wafer defects (column 6, lines 34-45). The aforementioned reads on,

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wherein said inorganic cores comprise nanoporous particles, **in claim 6;**

wherein said inorganic cores comprise a first material coated with a second material, said second material different from said first material, **in claim 7;**

Since Kaufman uses a cmp slurry that contains the same components as claimed by the applicants, then using Kaufman's slurry, which comprises a surfactant (selective adsorption additive) in the same manner as claimed by the applicants would result the same

wherein said selective adsorption additive exhibits substantial adsorption to said dielectric layer, said dielectric film selected from the group consisting of silicon dioxide, silicon nitride and low K materials, wherein said selective adsorption additive exhibits substantial adsorption to said dielectric layer, said dielectric film selected from the group consisting of silicon dioxide, silicon nitride and low K materials, **in claim 9;**

wherein said selective adsorption additive exhibits adsorption to a copper or silver containing film greater than adsorption to said refractory metal based barrier film, **in claim 10;**

wherein a selectivity of a CMP process using said slurry is at least approximately 20 for said refractory metal based barrier film compared to said dielectric film, said dielectric film comprising a silicon dioxide or low K film, **in claim 11;**

wherein a selectivity of a CMP process using said slurry is at least approximately 100 for said refractory metal based barrier film compared to said dielectric film, said dielectric film comprising a silicon dioxide or low K film, **in claim 12;**

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wherein a selectivity of a CMP process using said slurry is at least 0.5 for said refractory metal based barrier film compared to a layer comprising copper or silver, **in claim 13;**

wherein a selectivity of a CMP process using said slurry is at least 2.0 for said refractory metal based barrier film compared to a layer comprising copper or silver, **in claim 14;**

wherein a selectivity of a CMP process using said slurry is at least approximately 100 for a layer comprising copper or silver compared to said dielectric film, said dielectric film comprising a silicon dioxide or low K film, **in claim 15;**

wherein a selectivity of a CMP process using said slurry is at least approximately 1000 for a film comprising copper or silver compared to said dielectric film, said dielectric film comprising a silicon dioxide or low K film, **in claim 16;**

wherein said slurry provides adsorption ratio, as specified **in claims 38-43;** and selective adsorption ratio, as specified **in claims 44-46.**

The above aforementioned further reads on,

the slurry comprising at least one oxidizer, and wherein said oxidizer is at least one selected from the group consisting of hydrogen peroxide (column 5, lines 32-37), respectively **in claims 36 and 37.**

Kaufman teaches, "The CMP slurry of this invention also includes a film forming agent" (column 5, lines 44-45). "A preferred film forming agent is benzotriazole ("BTA")" (column 5, lines 55-56), which reads on,

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the slurry further comprising at least one passivating additive for inhibiting the oxidation of a copper or silver, **in claim 18**; and

wherein said passivating additive comprises at least one selected from the group consisting of benzotriazole (BTA), **in claim 19**.

Kaufman teaches, "Useful complexing agents include but art not limited to acids such as citric, lactic, tartaric, succinic, acetic, oxalic and other acids, . . ." (column 6, lines 5-8), which reads on,

the slurry further comprising at least one complexing agent, **in claim 20**;

wherein said complexing agent comprises at least one selected from the group consisting of acetic acid, citric acid, tartaric acid and succinic acid, **in claim 21**.

Kaufman also teaches, "a variety of optional CMP slurry additives, such as surfactants, . . . can be used." "If a surfactant is added to the CMP slurry, then it may be an anionic, cationic, nonionic, or amphoteric surfactant or a combination of two or more surfactants can be employed. " (column 6, lines 38-41). "Preferred surfactants include dodecyl sulfate sodium salt, sodium lauryl sulfate, . . . and mixture thereof" (column 6, lines 62-64). The above reads on,

wherein said selective adsorption additive comprises at least one surfactant selected from the group consisting of non-ionic, an ionic, cationic and zwitterionic surfactants, **in claim 22** and

wherein said selective adsorption additive comprises at least one surfactant selected from the group consisting of SAS and SDS, **in claim 23**.

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Kaufman, teaches, "Other well known polishing slurry additives may be incorporated into the chemical mechanical polishing slurry of this invention" (column 6, lines 22-24). "Useful inorganic additives include . . . ammonium fluoride, ammonium salts, . . ." (column 5, lines 28-31), which reads on,

The slurry comprising at least one salt, **in claim 31**; and wherein said salt is at least one selected from the group consisting of ammonium-based salts, **in claim 32**.

Kaufman teaches the pH of the CMP slurry of this invention is maintain within a range of from 2.0 and 12.0, and preferably between 4.0 and 9.0 (column 8, lines 22-25), which falls within the range wherein a pH of said slurry is 6 to 13, **in claim 33** and 8 to 11, **in claim 34**.

Kaufman teaches, ". . . metal oxide abrasives (same as applicant's core particles) typically ranges from about 3% to about 45 % solids . . ." (column 8, lines 10-15), which falls within the concentration of said core particles in said slurry is form approximately 1% to 40% by weight, **in claim 35**.

Since Kaufman uses a cmp slurry that comprises the same chemicals as those the claimed invention (Specification, page 13, line 2 – 17, line 10) then using Kaufman's slurry in the same manner as the claimed invention would result the same in a selectivity for a CMP process of at least approximately 50 for a refractory metal based barrier film compared to a silicon dioxide or low K film dielectric film, **in claim 47** and provides a selectivity for a CMP process of at least approximately 100 for said copper film compared to a silicon dioxide or low K film dielectric film, **in claim 48**.

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6. Claims 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman (US '997) as applied to claim 1 above, and further in view of Yano (US 6,545,819 B1).

Kaufman differs in failing to teach slurry comprises at least one organic solvent.

Yano teaches, "The medium of the aqueous dispersion (or CMP slurry, column 10, lines 30) may be water alone, or it may be a mixed medium containing an organic solvent . . . , so long as the polymer do not dissolve" (column 10, lines 9-12).

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Kaufman using an organic solvent as taught by Yano for the purpose of not dissolving the polymer particles (Yano, column 10, lines 18-21).

7. Claims 24-26, 29, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaufman (US '997) as applied to claim 1 above, and further in view of Wake et al. (US 6,436, 811).

Kaufman differs in failing to disclose wherein said selective adsorption additive comprises CTAB or CTAC, in claims 24 and 25;

wherein said selective adsorption additive comprises at least one polymer, in claim 29;

wherein said polymer is at least one selected form the group consisting of the polymers as specified in claim 30; and

to specify the concentration of the surfactant is from 0.1 to 1000 of a bulk CMC, in claim 28 and 0.5 to 1000 of the said CMC, in claim 29.

Wake teaches," Examples of surfactant dispersing agents include anionic, cationic, ampholytic and nonionic surfactants. . . . and heterocyclic compounds; for example, cetyl-trimethyl-ammonium chloride (CTAC), cetyl-trimethyl-ammonium bromide (CTAB)," (column 8, lines 11-28). "Nonionic polymers include polyvinylalcohol, . . . polyethylene glycol and polyacrylamide" (column 8, line 67 – column 9, line 2). Since Wake teaches the same surfactants as those of the claimed invention then combining Wake's surfactants with Kaufman's polishing slurry and using the combination in the same manner as the claimed invention would result wherein the surfactant having a concentration as specified in claims 27 and 28.

Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Kaufman by using the surfactant as taught by Wake for the purpose of preventing adhesion of a polishing product to a polishing pad and to form a uniform interconnect layer with an improved throughput, when polishing a large amount of copper-containing metal during a polishing step (Wake, column 4, lines 42-46).

Response to Arguments

8. Applicant's arguments with respect to claims 1-48 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 571-272-1470. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

ltue

May 24, 2003

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

